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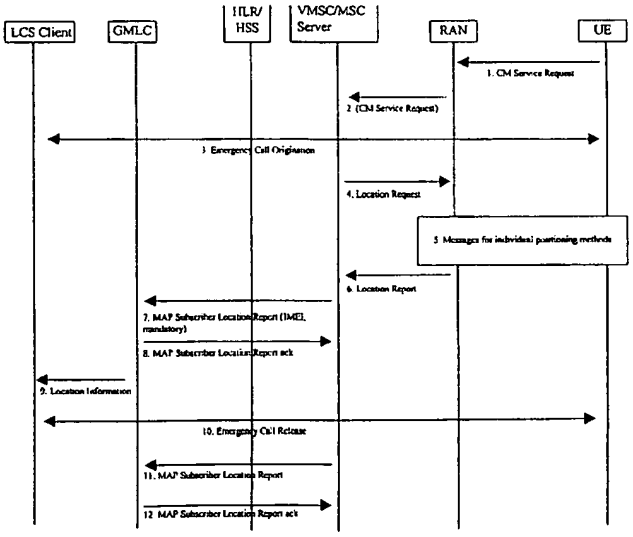
(54) Title: SYSTEM AND METHOD FOR THE POSITIONING OF A SUBSCRIBER DURING AN EMERGENCY CALL PERFORMED BY A MOBILE PHONE WITHOUT A VALID SIM CARD



(57) Abstract: The invention relates to a system for univocally identifying a mobile subscriber during an emergency call performed by a mobile phone without a SIM card or with an unvalid SIM card, to determine its updated geographic position, characterised in that, in messages of the positioning procedure, international mobile equipment identity (IMEI) is used to univocally discriminate the subscribers to be positioned during an emergency call in case they have the same non-dialable call back number, said international mobile equipment identity (IMEI) being made mandatory in said messages when both international mobile subscriber identy (IMSI) and mobile subscriber ISDN number (MSISDN) are not available as dialable call back number.

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SYSTEM AND METHOD FOR THE POSITIONING OF A SUBSCRIBER DURING AN EMERGENCY CALL PERFORMED BY A MOBILE PHONE WITHOUT A VALID SIM CARD

* * * *

The present invention relates to a new system which can provide univocal information about the location of a mobile subscriber during an emergency call (e.g. of E-911 type in use in North America) performed by a mobile phone without a SIM (=Subscriber Identity Module) card or with an unvalid SIM card.

The invention can be applied to both GSM and UMTS technologies, and in the context of both Circuit Switch (CS) and Packet Switch (PS).

The standard architecture of the mobile positioning system is the one represented in fig. 1 of the appended drawings.

The Gateway Mobile Location Center (GMLC) implements functionalities required to support the Location Services LCS. In one network, there may be more than one GMLC. Each GMLC is the first node for the accesses of an external LoCation Services Client (LCS Client) in a mobile network. The GMLC may request routing information from a global register - Home Location Register (HLR) or Home Subscriber Server (HSS) - of the subscribers of the operator. Furthermore the GMLC contains information allowing to perform authentication and authorization activities of external LCS Client entities requiring location of mobile users. After having obtained the routing information and performed the authorization and authentication activities of the external LCS Clients, the GMLC sends the location request to the Mobile Switching Center/Visitor Location Register (MSC/VLR) or Serving GPRS Support Node (SGSN) and receives information about the geographic coordinates of the mobile user terminal whose location has been requested from the corresponding entities.

The HLR/HSS register contains all subscription user data, including the LCS subscription user data, and routing information. For a roaming mobile subscriber, the HRL/HSS may be in a network different from the one he is currently roaming into. In other words, should the user be roaming in the network of an operator different from the one he subscribes to, the HLR/HSS register is always the one of the operator the user subscribes to. The MSC/VLR or SGSN implements the functional activities for authorizing and handling location requests relating to the subscriber.

The system provides the opportunity of requesting the location of the mobile user terminals from an external LCS Client (Mobile Terminating Location Request = MT-LR), the location from the terminal itself (Mobile Originating Location Request = MO-LR) and the auto-induced location from network (Network Induced-Location Request = NI-LR).

The LCS functions of MSC/VLR and SGSN are related to charging and billing, coordination, location request, authorization and operation of the LCS services.

In the appended drawings:

fig. 1 illustrates, as already mentioned, the standard architecture of the positioning system the present invention relates to;

figs. 2 and 3 represent the main signalling between nodes in case of an emergency call in positioning procedures according to the state of the art, for the initial location and the updated location of the subscriber, respectively; and

figs. 4 and 5 represent the main signalling between nodes when the positioning system according to the invention is adopted, for the initial location and the updated location of the subscriber, respectively.

According to the state of the art, the procedure, in case of positioning due to an emergency call (with NI-LR = Network Induced Location Request), takes place, as represented in figs. 2 and 3.

After the initial location has been delivered to LCS client through the message 9 of Fig. 2, the LCS client may ask to know (fig. 3) the updated UE location by means of MT-LR without HLR query procedure.

The MAP message "PROVIDE_SUBSCRIBER_LOCATION" sent to the VMSC (=Visited Mobile Service Switching Center), through the message 2 of fig. 3, carries the IMSI (=International Mobile Subscriber Identity), MSISDN (Mobile Subscriber ISDN Number) or an emergency service routing key, as NA-ESRK (=North American Emergency Service Routing Key, which uses the known telephone number 911), and, if provided, the IMEI (=International Mobile Equipment Identity) for the target UE, as well as the required QoS (=Quality of Service) of the required service and indication of a location request from an emergency service user. The VMSC identifies the target UE using IMSI, MSISDN or NA-ESRK and, if provided, IMEI. In case the UE has no SIM or is provided with a not valid SIM, in a North American Network

System, a non-dialable call back number derived from the IMEI can be used, in place of MSISDN, in order to reach the subscriber.

In case the UE has no SIM card or is provided with a non valid SIM card, and neither IMSI nor MSIDSN are available, there is no chance, according to the state of the art, to univocally address the correct subscriber both in the GMLC, upon reception of the MAP message "SUBSCRIBER_LOCATION_REPORT" (see fig. 2) and in the VMSC, when the MAP message "PROVIDE_SUBSCRIVER_LOCATION" is received (see fig. 3).

In fact, the emergency service routing key (e.g. the already mentioned NA-ESRK using number 911) is not always available and is not supported in the MAP message "PROVIDE_SUBSCRIBER_LOCATION" (see fig. 3); the non-dialable call-back number used in place of MSISDN is then made of 911 + the last 7 digits of IMEI and does not identify the subscriber in an univocal manner. In fact, e.g., two subscribers having the same last 7 digits of the IMEI would have the same non-dialable call-back number.

Moreover, the use of the IMEI is non mandatory in the MAP messages being used.

The basic idea of the present invention is to overcome the problem described in the previous paragraphs by providing a mechanism which allows the VMSC and GLMC to univocally identify the subscriber involved in the positioning procedure, even in case the emergency call is performed by a mobile phone without a SIM or with an unvalid SIM and neither the IMSI nor the MSIDSN as dialable call-back number are available.

More precisely, the invention relates to a system for univocally identifying a mobile subscriber during an emergency call performed by a mobile phone without a SIM card or with an unvalid SIM card, to determine its updated geographic position, characterised in that, in messages of the positioning procedure, international mobile equipment identity (IMEI) is used to univocally discriminate the subscribers to be positioned during an emergency call in case they have the same non-dialable call back number, said international mobile equipment identity (IMEI) being made mandatory in said messages when both international mobile subscriber identy (IMSI) and mobile subscriber ISDN number (MSISDN) are not available as dialable call back

number.

The invention relates also to a method to carry out said system, which provides:

- that the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) sends mandatorily the subscriber international mobile equipment identity (IMEI) to gateway mobile location center (GMLC) at notification of the initial geographic position of the subscriber;
- that the gateway mobile location center (GMLC) discriminates two or more subscriber through the subscriber international mobile equipment identity (IMEI) received from the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) when the mobile subscriber ISDN number (MSISDN) of different users carries the same non-dialable call back number and the emergency service routing key (as, for example NA-ESRK) is not available;
- that the gateway mobile location center (GMLC) sends mandatorily the international mobile identity (IMEI) of the subscriber which updated geographic position is requested, during the emergency call, to the mobile switching center (MSC) or visitor location regiser (VLR) or serving GPRS support node (SGSN), in the case in which the mobile subscriber ISDN number (MSISDN) is not available as dialable call back number;
- and that the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) discriminates, through the subscriber international mobile equipment identity (IMEI) received from gateway mobile location center (GMLC), two or more subscribers, during the updating procedure of the geographic position of the subscriber, while the emergency call without SIM card or with an unvalid SIM card is performed.

Furthermore, the invention refers to a computer program loadable in a memory apt to perform the steps of the above method.

Referring to figs. 4 and 5 of the appended drawings, the invention implies that the IMEI is used as a mandatory parameter in the MAP messages "SUBSCRIBER_LOCATION_REPORT" (see figs. 2-3) and "PROVIDE_SUBSCRIBER_LOCATION" (see fig. 3), in case neither the IMSI nor the MSISDN are available as dialable call-back number.

The invention is shown applied in Figs. 4 and 5 of the enclosed drawings, see the message 7 of Fig. 4 and the message 2 of Fig. 5. In Fig. 4 it is shown, in fact, that – when a location request induced by NI-LR network is performed because of an emergency call - IMEI is, according to the invention, mandatory in the MAP message "SUBSCRIBER_LOCATION_REPORT" (message 7 of Fig. 4), if neither IMSI nor MSISDN (in form of dialable call-back number) are message 7 available.

In other words, according to the invention, MSC/VLR or SGSN sends IMEI to GMLC, as a mandatory parameter, at the notification of the initial geographic position of the subscriber, through the map message "SUBSCRIBER_LOCATION_REPORT". Upon reception of this message, in case two different calls have the same MSISDN (as non dialable call-back number), the GMLC can distinguish them by means of the IMEI received.

As shown in fig. 5, after receiving the MAP message "SUBSCRIBER_LOCATION_REPORT" if the updated location is needed, IMEI is used ad a mandatory parameter in the MAP message "PROVIDED_SUB-SCRIBER_LOCATION_REPORT" (message 2 of Fig. 5), during the MT-LR, without the HLR Query procedure.

In other words, according to the invention, GMLC sends mandatorily the IMEI of the subscriber to MSC/VLR or SGSN during the updating procedure of the geographic position of the subscriber, through the message "PROVIDE_SUBSCRIBER_LOCATION". Upon receipt of this message, if the MSISDN (as a non dialable call-back number) has been received, the VMSC uses the IMEI to identify the call and the related subscriber to be positioned.

Thus the present invention allows in any case the univocal and updated positioning, during an emergency call performed by a mobile phone without a SIM card or with an unvalid SIM card, without any ambiguity on the mobile phone to be positioned, both in the GMLC and VMSC.

CLAIMS

1) A system for univocally identifying a mobile subscriber during an emergency call performed by a mobile phone without a SIM card or with an unvalid SIM card, to determine its updated geographic position, characterised in that, in messages of the positioning procedure, international mobile equipment identity (IMEI) is used to univocally discriminate the subscribers to be positioned during an emergency call in case they have the same non-dialable call back number, said international mobile equipment identity (IMEI) being made mandatory in said messages when both international mobile subscriber identy (IMSI) and mobile subscriber ISDN number (MSISDN) are not available as dialable call back number.

2) A method for univocally identifying a mobile subscriber during an emergency call performed by a mobile phone without a SIM card or with an unvalid SIM card, to determine its updated geographic position, characterised in that it provides:

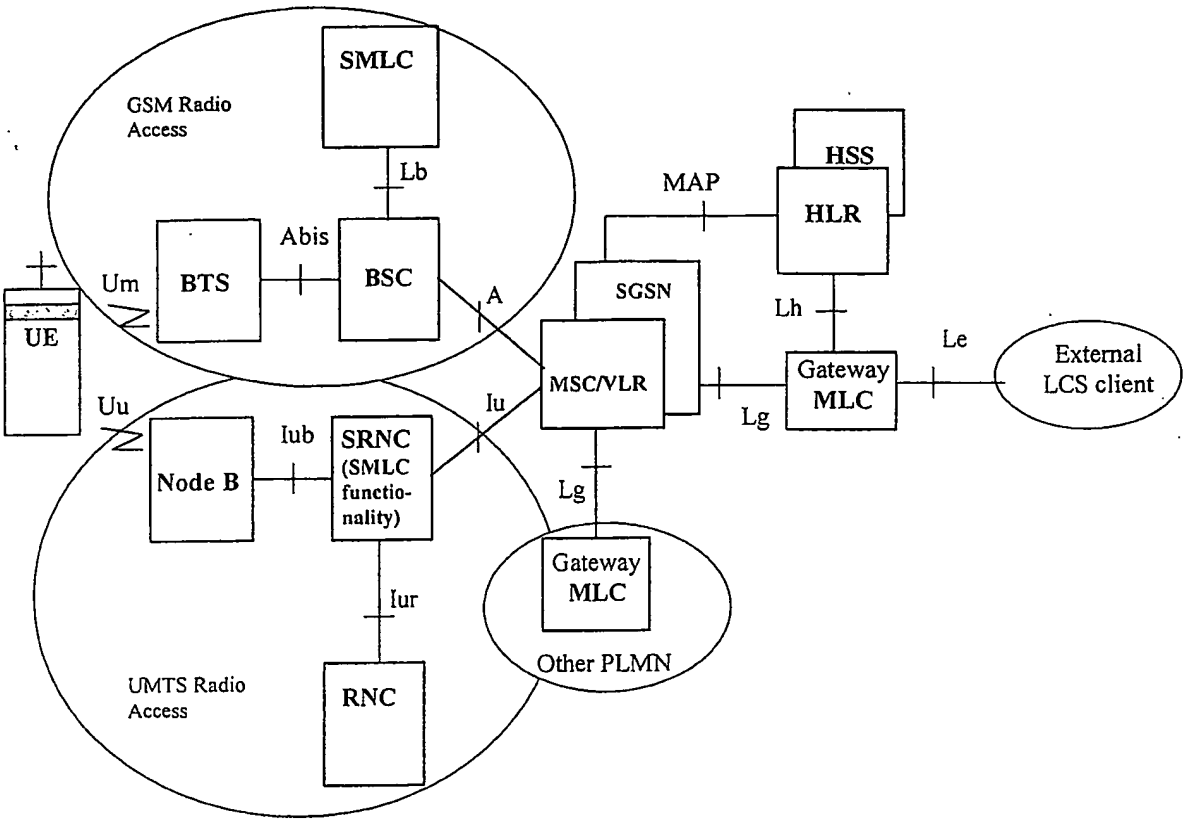
- that the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) sends mandatorily the subscriber international mobile equipment identity (IMEI) to gateway mobile location center (GMLC) at notification of the initial geographic position of the subscriber;
- that the gateway mobile location center (GMLC) discriminates two or more subscriber through the subscriber international mobile equipment identity (IMEI) received from the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) when the mobile subscriber ISDN number (MSISDN) of different users carries the same non-dialable call back number and the emergency service routing key (as, for example NA-ESRK) is not available;
- that the gateway mobile location center (GMLC) sends mandatorily the international mobile identity (IMEI) of the subscriber which updated geographic position is requested, during the emergency call, to the mobile switching center (MSC) or visitor location regiser (VLR) or serving GPRS support node (SGSN), in the case in which the mobile subscriber ISDN number (MSISDN) is not available as dialable call back number;
- and that the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) discriminates, through the subscriber

international mobile equipment identity (IMEI) received from gateway mobile location center (GMLC), two or more subscribers, during the updating procedure of the geographic position of the subscriber, while the emergency call without SIM card or with an unvalid SIM card is performed.

3) A method as in claim 2) in which the mobile switching center (MSC) or visitor location register (VLR) or serving GPRS support node (SGSN) sends the subscriber international equipment identity (IMEI) to the gateway mobile location center (GMLC) at notification of the initial geographic position of the subscriber, through the MAP message "SUBSCRIBER_LOCATION_REPORTER".

4) A method as in claim 2) in which the gateway mobile location center (GMLC) sends the subscriber international equipment identity (IMEI) to the mobile switching center (MSC) or visitor location register (VLR) or serving (GPRS) support node (SGSN) during the subscriber geographic position updating procedure, through the MAP message "PROVIDE_SUBSCRIBER_LOCATION".

5) Computer program loadable in a memory apt to perform the steps of the method as in claims 2) to 4).


SMLC
GSM Radio Access
Lb
HSS
MAP
HLR
Abis
BTS
BSC
Um
A
SGSN
Lh
UE
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External LCS client
MSC/VLR
Gateway MLC
Uu
Iu
Lg
Iub
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Node B
Lg
Gateway MLC
Other PLMN
Iur
UMTS Radio Access
RNC

Fig. 1

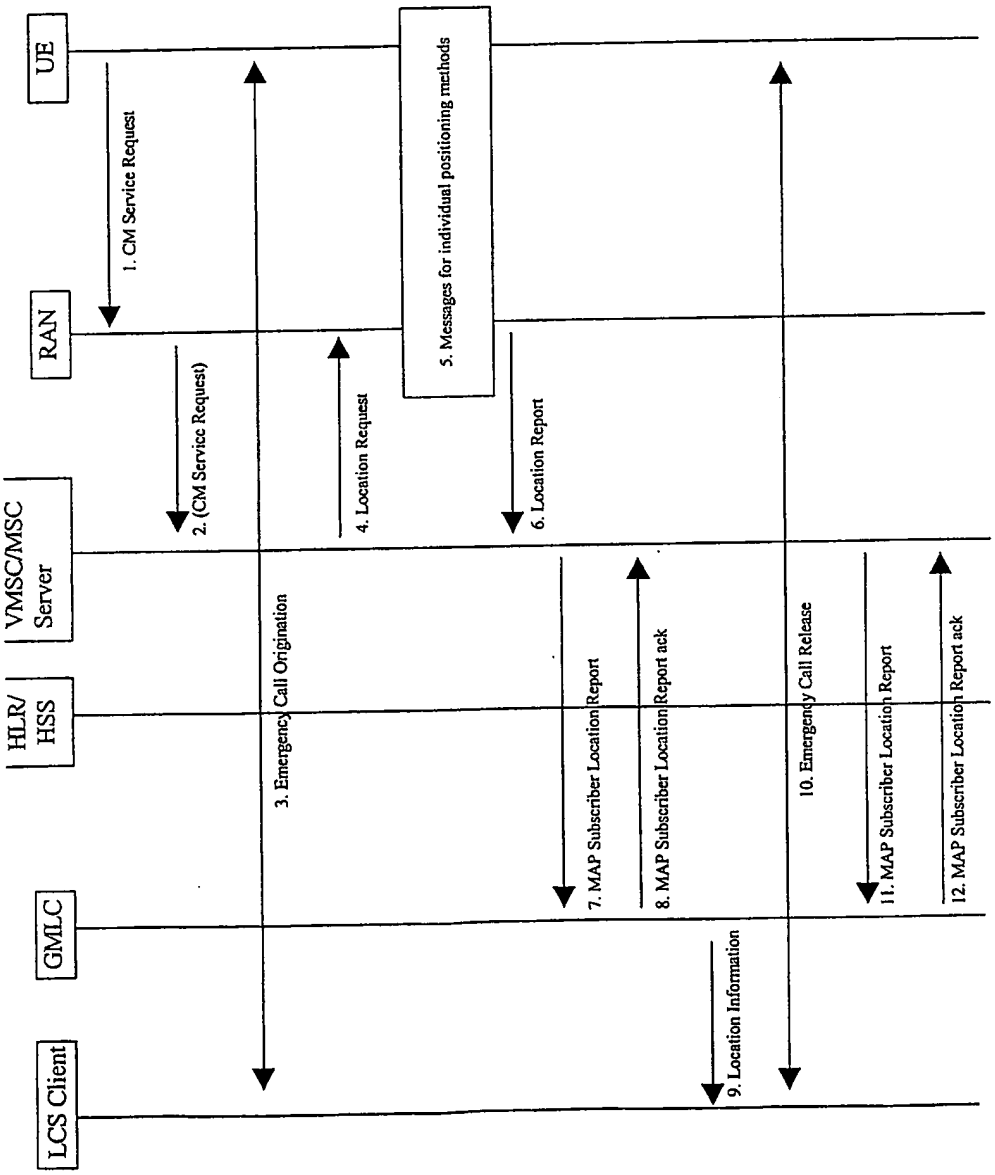
UE
RAN
VMSC/MSC Server
HLR/ HSS
GMLC
LCS Client
1. CM Service Request
2. (CM Service Request)
3. Emergency Call Origination
4. Location Request
5. Messages for individual positioning methods
6. Location Report
7. MAP Subscriber Location Report
8. MAP Subscriber Location Report ack
9. Location Information
10. Emergency Call Release
11. MAP Subscriber Location Report
12. MAP Subscriber Location Report ack

Fig.2

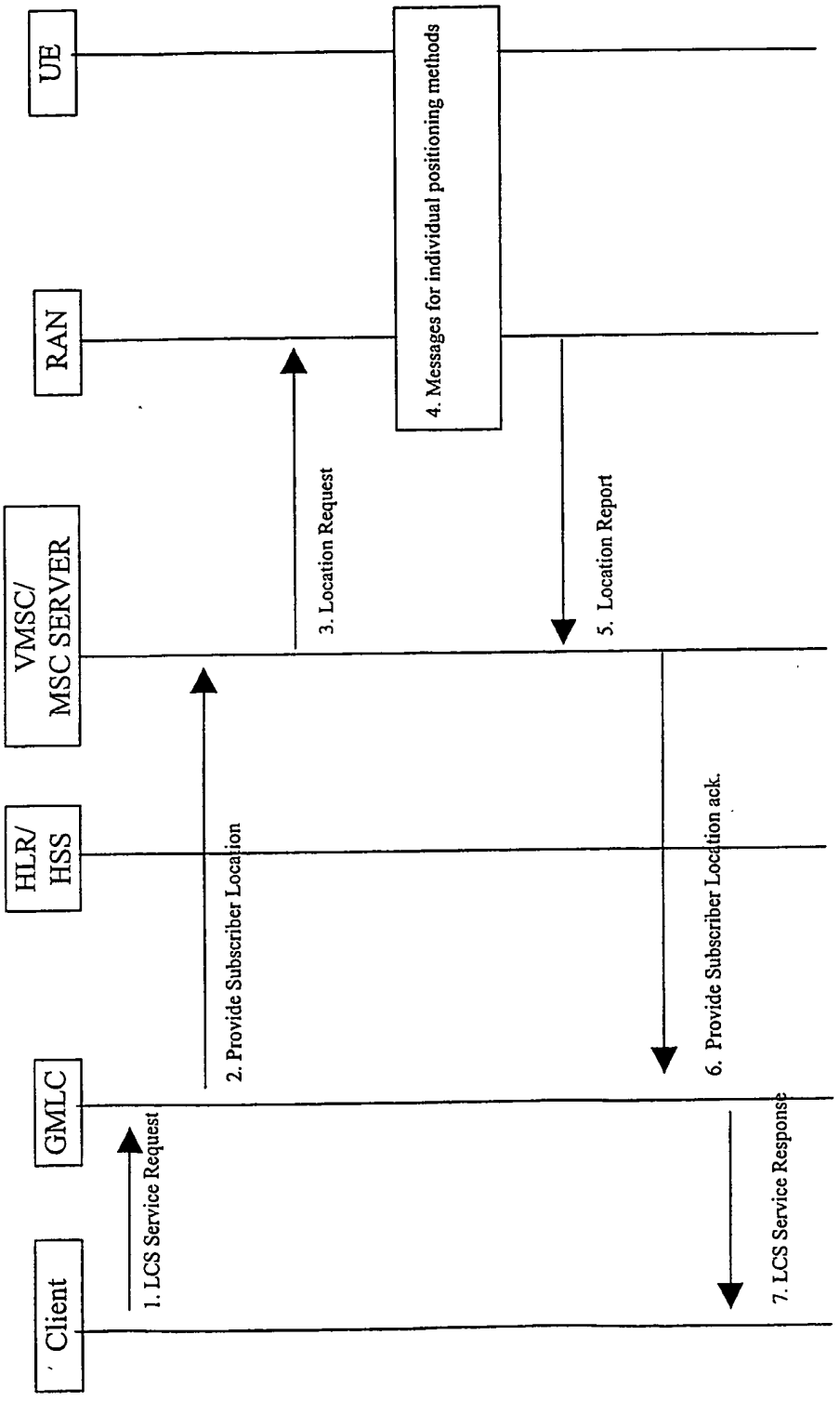
UE
RAN
VMSC/
MSC SERVER
HLR/
HSS
GMLC
Client
4. Messages for individual positioning methods
3. Location Request
5. Location Report
2. Provide Subscriber Location
6. Provide Subscriber Location ack.
1. LCS Service Request
7. LCS Service Response

Fig.3

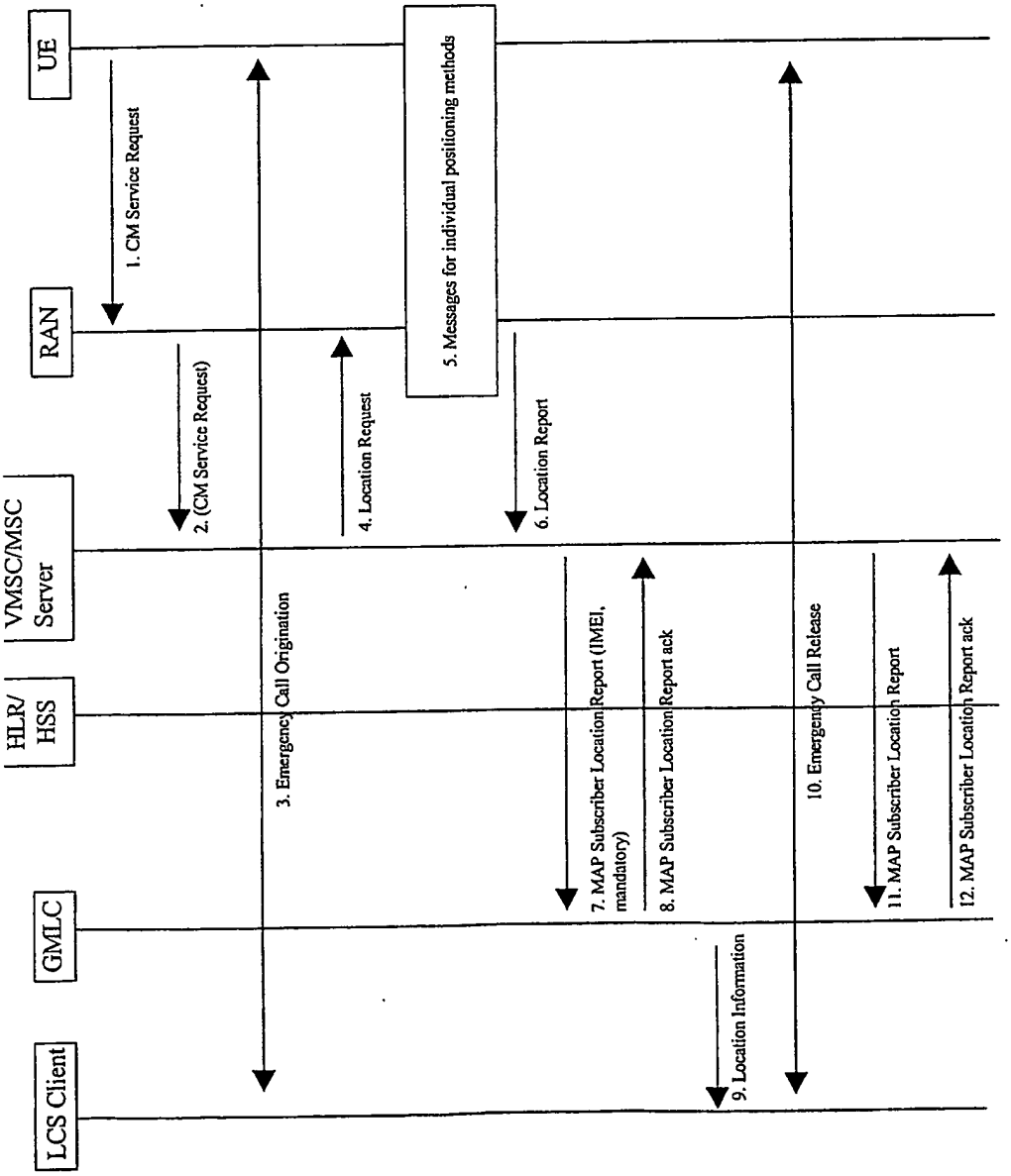
UE
RAN
VMSC/MSC Server
HLR/ HSS
GMLC
LCS Client
1. CM Service Request
2. (CM Service Request)
3. Emergency Call Origination
4. Location Request
5. Messages for individual positioning methods
6. Location Report
7. MAP Subscriber Location Report (IMEI, mandatory)
8. MAP Subscriber Location Report ack
9. Location Information
10. Emergency Call Release
11. MAP Subscriber Location Report
12. MAP Subscriber Location Report ack

Fig.4

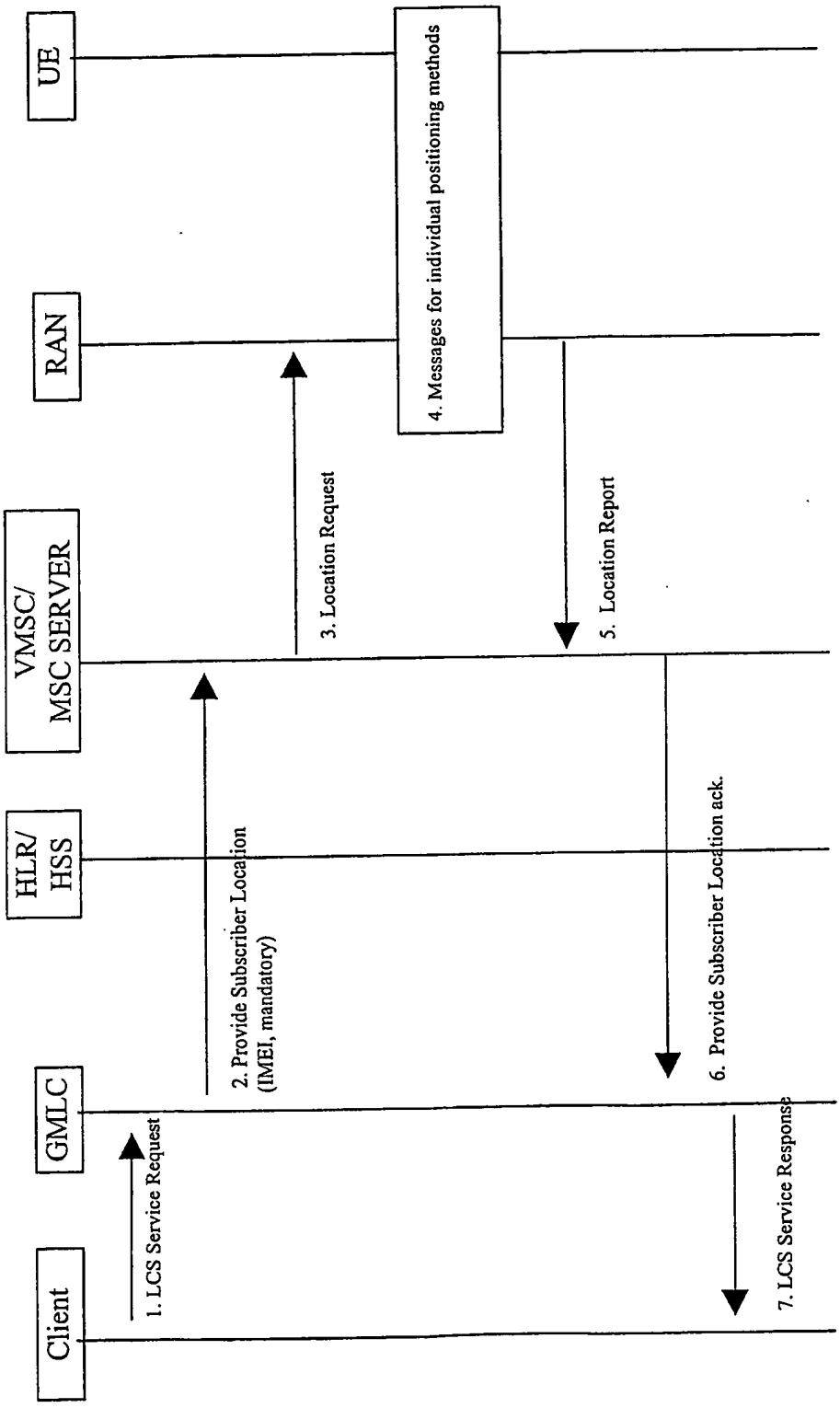
UE
RAN
VMSC/
MSC SERVER
HLR/
HSS
GMLC
Client
4. Messages for individual positioning methods
3. Location Request
5. Location Report
2. Provide Subscriber Location
(IMEI, mandatory)
6. Provide Subscriber Location ack.
1. LCS Service Request
7. LCS Service Response

Fig.5

INTERNATIONAL SEARCH REPORT

Inte Application No
PCT/IT 01/00545

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC, PAJ, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 00 69199 A (NOKIA NETWORKS OY ;NAGHIAN SIAMAEK (FI)) 16 November 2000 (2000-11-16) page 31, line 6 -page 37, line 16; figures 7,8 ---	1-5
Y	"GSM 04.08 version 7.8.0 Release 1998" 1 October 2000 (2000-10-01) , ETSI , F-06921 SOPHIA ANTIPOLIS XP002204206 chapter 4.5.1.5 page 135 chapter 10.5.1.4 page 376 -page 378 ---	1-5
A	WO 00 41409 A (NOKIA NETWORKS OY ;EINOLA HEIKKI (FI); HUOTARI SEPPO (FI); BAECK J) 13 July 2000 (2000-07-13) page 8, line 19 - line 31 ---	1-5

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
2 July 2002	15/07/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Reeck, G

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 50268 A (FREITAG PETER ;WEGHORST INGO (DE); SIEMENS AG (DE)) 31 December 1997 (1997-12-31) claim 2	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter Application No
PCT/IT 01/00545

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0069199 A	16-11-2000	WO 0069199 A1	16-11-2000
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		EP 0910925 A1	28-04-1999